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diversions which to men occupying less responsible positions might be occasionally allowable if not always permissible.

No more hateful spectacle confronts advancing civilization than a beer-sipping, wine-bibbing college or university professor. He is hateful because he is incongruous. More than that, he is hateful because of the havoc he works as an iconoclast in the beautiful temple of youthful ideals. It is a safe prediction in the near coming day when the American saloon is only a historic tradition, that the college professor who drinks in public or in private will not be tolerated beyond the meeting of the board of trustees next succeeding his discovery, and I should say to you in perfect candor at this time, in order that there may be no misunderstanding from the beginning, that I will not serve on a teaching body with any man who uses intoxicating liquors in any form whatsoever. My responsibility to young manhood and womanhood for character ideals is too great to permit me to attempt to bear the burden of responsibility which I could not escape for a colleague who leads an immoral life.

SCIENTIFIC BOOKS

The Mutation Theory. Volume II. The Origin of Varieties by Mutation. By HUGO DE VRIES. English translation by Professor J. B. FARMER and A. D. DARBISHIRE. Pp. viii + 683. Six colored plates and 149 text-figures. Chicago, The Open Court Publishing Co. 1910.

In May, 1910,¹ the writer had the honor of reviewing Volume I. of the English translation of "Die Mutationstheorie." The inspiration which this volume brought to a large circle of readers made the appearance of volume two doubly welcome. The careful study of the first volume introduced many workers for the first time to the author's own statement of the essentials of the mutation theory, and these essentials, together with a brief summary of de Vries's many important and positive contributions to theoretical and practical biology, through this and his numerous

other related writings, were given in the above mentioned review.

Of volume two of the translation, Part I. includes Band I., Abschnitt 4, of the original, treating of The Origin of Horticultural Varieties, with chapters on The Significance of Horticultural Varieties in the Theory of Selection, Latent and Semi-latent Characters, The Different Modes of Origin of New Species, The Sudden Appearance of and the Constancy of New Varieties, Atavism, Experimental Observation of the Origin of Varieties, Non-isolable Races, and Nutrition and Selection of Semi-latent Characters.

Part II., The Origin of Eversporting Varieties, includes, from the original, Band II., Abschnitt 2, IV., The Origin of Eversporting Varieties, with four chapters on: I., Tricotylous Races (the title of the German original is "Kreuzung tricotyler Rassen"), omitting § 24 (Kreuzung der Mittletassen mit den Halbrassen) and § 25 (Kreuzung tricolyleyler Rassen von verschiedenen Arten); II., Syncotylous Races (Kreuzung syncotyler Rassen), omitting § 31 (Kreuzungsversuche); III., The Inconstancy of Fasciated Races (= Band II., Absch. 5, IV.), and IV., Heritable Spiral Torsions (= Band II., Absch. 5, IV.).

Part III. includes Band II., Abschnitt 6, treating of The Relations of the Mutation Theory to other Branches of Inquiry, embracing four chapters: I., The Conception of Species According to the Theory of Mutation; II., The Range of Validity of the Doctrine of Mutation; III., The Material Vehicles of the Heredity Characters; and IV., Geological Periods of Mutation.

Those portions of the original work treating of hybridization (including § 31 mentioned above, and Band II., Abschnitt 1, and Abschnitt 2, I.-III.) have been omitted from the first two volumes of the English translation. Thus the second volume is not merely a translation of volume two of the original. It covers largely the same ground as de Vries's English lectures, published under the title of "Species and Varieties, their Origin by Mutation," but has the advantage of illustrations, which were lacking from "Species and Varieties."

¹ *Science*, XXXI., 740-743, 1910.

The publication of volume two will help to dispel the erroneous, but still quite prevalent, notion that the theory of mutation is based entirely on observations of the evening-primrose. Even one who has himself carried on experimental pedigreed cultures can not but admire the thoroughness and patience with which thousands of individual plants of scores of different species were examined with minutest care in order to insure adequate grounds for inductive inference, or to secure sufficient data for the confirmation or rejection of a hypothesis. The conception and elaboration of this hypothesis of mutation is the most Darwin-like performance since Darwin, and is, without doubt, one of the most important fruits of Darwin's labors. Like the source of its inspiration (the "Origin of Species"), "Die Mutationstheorie" has given color and direction to all lines of biological inquiry, which will persist for decades to come.

As in volume one, so also throughout volume two, the author keeps close to Darwin's Darwinism, and insists that, far from being intended to supplant the theory of selection, as Darwin held it, the mutation theory is intended merely to complement the other. Thus on page 609: "To Darwin's mind the essential point was . . . that natural selection is a sieve. . . . It creates nothing, as is so often assumed; it only sifts. . . . How the struggle for existence sifts is one question; how that which is sifted arose is another." It is really difficult to conceive how careful readers could ever have confused the issue on this point. Any attempt to restate in this periodical the essence of the mutation-theory would now be out of place.

That phase of de Vries's philosophy which has perhaps met with the greatest opposition is his hypothesis of intracellular pangenesis. It has been rejected as too mechanical and too formal, one author implying that pangens are more "mechanical" than atoms and molecules! This is not the place to discuss the validity of intracellular pangenesis, but it must surely be recognized that as a working hypothesis it has fully justified itself, since it lies at the bot-

tom of all of de Vries's experiments, and of his own explanation of the results. Putting aside the question of its heuristic value, its framer says (p. 643): "for myself pangenesis has always been the starting point of my inquiries; at first only in a theoretical way, but afterwards also for the experimental investigations described in this book. Especially is it this hypothesis which has led me to search for mutations in the field." It is doubtful whether the field observations which led to the classical experiments with Lamarck's evening-primrose and thus to the actual observation of the origin of elementary species, would ever have been made if the hypothesis of intracellular pangenesis had not first taken form in our author's thought (see footnote 3, p. 643, and "Intracellular Pangenesis," English edition, p. 74, footnote).

Whether we accept intracellular pangenesis as an expression of truth or not, and even if we reject it as a working hypothesis, a clear understanding of it is absolutely essential in order to interpret the theory of mutation as it exists in the mind of de Vries. It was largely for this reason that the present writer thought it worth while to translate "Intracellular Pangenesis" into English.

In the language of intracellular pangenesis:

1. Premutation consists in the formation of a new pangen.
2. Progressive mutation consists in premutation, *plus the initial activation of the new pangen*. The result is a new elementary species.
3. Retrogressive mutation is the reverse of progressive mutation; it consists in the return of a pangen from an active to a latent condition. White-flowered varieties are thus caused.
4. Degressive mutation consists in such a transposition of pangens that either (a) the more recently activated pangens become semi-latent, being active in rare instances only, thus giving rise to a *half-race* (e. g., wild four-leaved clovers, and other teratological forms); or (b) the active pangens become semi-active, giving rise to ever-sporting varieties, middle races (e. g., *Trifolium pratense quinquefolium*

(five-leaved clovers), *Plantago lanceolata ramosa*, and variegated leaves).

"If one of the two parents [in a cross] stands in the relation to the other of having arisen from it by retrogressive or degressive mutation," the progeny, in successive generations, follow Mendel's laws; otherwise they do not, and the result of a cross is then a uni-sexual, or constant hybrid race. Constant hybrid races correspond to progressive mutations, the Mendelian law to retrogressive and degressive forms of differentiation (pp. 576-577).

But though the mutation theory is a direct outgrowth of the hypothesis of intracellular pangenesis, it fortunately does not stand or fall with the latter, for no scientific theory ever had a firmer foundation in fact—in experimental evidence—than that of mutation.

De Vries claims to have demonstrated experimentally that: (1) "Ordinary or fluctuating variability does not provide material for the origin of new species" (p. 56). While this does not exclude the possibility of different modes of origin of new species, still "Inferences drawn from data after its appearance can hardly be considered as decisive" (p. 56). That is, *the problem is an experimental one*. (2) "The elementary species are demonstrably the existing units of the system; whilst the larger species are only aggregations of these." (3) Elementary species (the theory has nothing to do, except indirectly, with the mode of origin of taxonomic groups) do arise by the method of mutation (discontinuous variation). They have time and again, in a wide variety of sorts, been seen so to arise. No one has ever actually witnessed the origin of a species by any other method.

It is probable that the doctrine of the elementary units of organisms will ultimately prove to be de Vries's most important contribution; though perhaps this doctrine means less to the advancement of philosophical and experimental biology than the firm establishment of the fact, quoted on the fly-leaf of "Species and Varieties," that "The origin of species is an object of experimental investigation." The demonstration of this fact, so

conclusively as to compel practically every investigator to acknowledge its truth, is the greatest service rendered to evolutionary biology since Darwin.

On the whole, the translators have performed their work well, though in a few places (*e. g.*, on pp. 608 and 609, cf. German edition, Vol. II., pp. 666), the English can hardly be regarded as a translation of the original. The color plates and the text-figures, notably plate IV., and figures 26, 40 and 54, are quite inferior to those of the German edition. However, it is not easy to find points to criticize adversely, and every one is hoping that an English edition of the now omitted portions, by the same translators, will soon appear.

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Outlines of the Theory of Electromagnetism.

By GILBERT T. WALKER. Cambridge, University Press. 1910.

This volume contains a series of lectures delivered before the Calcutta University on some of the more important developments of electromagnetic theory. The chief novelty of it, compared with other English books on mathematical physics, lies in the consistent use of vector methods, and their advantage is shown by the large amount of material condensed into fifty-two pages. While little of the material is new, the book will be of great assistance to those who wish to familiarize themselves with the present condition of the theory, as well as to those who wish to obtain a working knowledge of vector methods applied to physical problems. For the latter object no better course could be devised than a careful study of this book, with frequent transformations of the vector formulæ into their more familiar Cartesian equivalents.

The first chapter gives an outline of vector analysis, including the vector expressions for the more important analytical theorems of constant use. In the second chapter vector methods are applied to magnetostatics, and